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OPERATING GUIDE

MODEL 7500M11

Variable Capacitance Accelerometer

SUPPLEMENTAL OPERATING GUIDE
MODEL 7500M11 ACCELEROMETER

INTRODUCTION

Dytran Model 7500M11 is a high performance, wide temperature range variable capacitance (VC) accelerometer. It combines an integrated VC accelerometer chip with high drive, low impedance buffering for measuring acceleration in commercial/industrial environments. It is tailored for zero to medium frequency instrumentation applications. This module contains a hermetically sealed micromachined capacitive sensing element, a custom integrated circuit amplifier, and differential output stages. The hermetically sealed stainless steel case has an integral Glenair Plug 800-006-06Z16-4SX "Mighty Mouse" connector, and is easily mounted via two #4 or M3 screws. On-board regulation is provided to minimize the effects of supply voltage variation. It is relatively insensitive to temperature changes and thermal gradients. The power and signal wires are isolated from the case. An initial calibration sheet is included and periodic calibration checking is available.

OPERATION

Model 7500M11 accelerometer modules produce two analog voltage outputs which vary with acceleration as shown in the graph of Figure 1. The sensitive axis is perpendicular to the bottom of the package, with positive acceleration defined as a force pushing on the bottom of the package. The signal outputs are fully differential about a common mode voltage of approximately 2.5 volts. The output scale factor is independent from the supply voltage of +9 to +32 volts. At zero acceleration the output differential voltage is nominally 0 volts DC; at ± full scale acceleration the output differential voltage is ±2 volts DC.

CABLE LENGTH CONSIDERATIONS

Cable lengths of up to 15 meters (50 feet) can be used with the 7500M11 accelerometer. For lengths longer than 15 meters, we recommend you check each individual installation for oscillation by tapping the accelerometer and watching the differential output for oscillation in the 20kHz to 50kHz region. If no oscillation is present, then the cable length being used is OK. From the standpoint of output current drive and slew rate limitations, the Model 7500M11 is capable of driving over 600 meters (2000 feet) of its cable type but at some length between 15 and 600 meters, each device will likely begin to exhibit oscillation.

ADDING A SINGLE ENDED OUTPUT

To achieve the highest resolution and lowest noise performance from the Model 7500M11 accelerometer, it should be connected to a voltage measurement instrument in a differential configuration using both the AOP and AON output signals. If the measurement instrument lacks differential input capability, or it is desired to use a differential input capable instrument in single ended mode, then the circuit shown in Figure 2 can be used to preserve the low noise performance of the Model 7500M11 while using a single ended type connection.

This circuit converts the ±2V differential output of the Series 7500M11 accelerometer, centered at +2.5 volts, to a single ended output centered about ground (0.0Vdc). It provides the advantage of low common mode noise by preventing the accelerometer's ground current from causing an error in the voltage reading.

The op-amp should be located as close as possible to the voltage monitoring equipment. The majority of the signal path can therefore be differential so any noise will affect the wire run as a common mode signal which will be rejected. The op-amp type is not critical; a µA741 or a ¼ of a LM124 can be used. The power supplies need to be ±5V to ±15V to allow for both positive and negative output swing.

The gain of the op-amp is determined by the ratio R2/R1 (where R4=R2 and R3=R1). If R1 through R4 are all the same value, the gain equals 1 and the output swing will be ±4V single ended with respect to ground. To obtain a ±5V single ended output, set R2/R1=R4/R3=5/4=1.25. The single ended output of the op-amp will be centered at ground if R2 and C1 are tied to ground; using some other fixed voltage for this reference can shift the output. The value of the optional capacitors C1 and C2 (C1=C2) can be selected to roll off the frequency response to the frequency range of interest.

SINGLE ENDED MODE (EQUIPMENT)

For the best performance we recommend differential mode, however if only single ended data acquisition equipment is available you should follow these guidelines, see Figures 3 and 4 for Reference.

Single ended sensitivity is half the differential sensitivity. Data sheets will contain information specific to each accelerometer.

In single ended mode Full Scale is between +.5 to 4.5 Volts. If you are seeing voltages outside this range and recheck your connections.

All of the test data on the NIST traceable calibration sheets or printed on the ESD bag label are for differential mode. Dividing the differential value by 2 does not always provide the most accurate Scale Factor value. For lower G units we suggest you use a +/1G Flip Test Calibration (using Earth's gravity) to determine single ended values for 0G Bias and Scale Factor.

The output wiring AOP/ AON provides actual voltage signals. When using the sensor in single ended mode only the +AOP signal wire are used.

The unused -AON signal wires should be either trimmed off or well insulated with electrical tape. Connecting these (-) wires to the frame of the test equipment or to the 0 volt power supply rail will potentially cause the sensor to overheat. and prematurely fail. Test equipment like oscilloscopes with BNC type connections may often cause this problem, since the outside shell of the BNC typically connects directly to the frame ground of the instrument. See the attached information regarding using an oscilloscope. One of the first symptoms of this is unstable readings with increasing electronic noise as the output circuits of the accelerometer overheat.

DIFFERNTIAL MODE WITH AN OSCILLOSCOPE

Connecting the AOP+ and AON- signal to an oscilloscope using conventional oscilloscope probe will ground the AON – signal to the case of the device, can cause signal problems, and may casue the accelerometer to overheat and eventually fail.

Use a differential probe to make sure both AOP+ and AON – remain isolated from the ground of the oscilloscope.

MAINTENANCE AND REPAIR

Should you experience a problem with your system, contact the Dytran factory for technical assistance in analyzing and trouble shooting the problem. If the product must be returned for evaluation and/or repair, you will be given an RMA (returned materials authorization) number and instructions for returning the instrument to the factory. Do not return the instrument without first obtaining this authorization to return.

Figure 1

SIGNAL DESCRIPTIONS

Vs and GND (Power): Red and Black wires respectively. Power (+9 to +32 Volts DC) and ground.

AOP and AON (Output): Green and White wires, respectively. Analog output voltages proportional to acceleration; AOP voltage increases (AON decreases) with positive acceleration. At zero acceleration both outputs are nominally equal to 2.5 volts. The device experiences positive (+1g) acceleration with its lid facing up in Earth's gravitational field. Either output can be used individually or the two outputs can be used differentially. (See output response plot below.

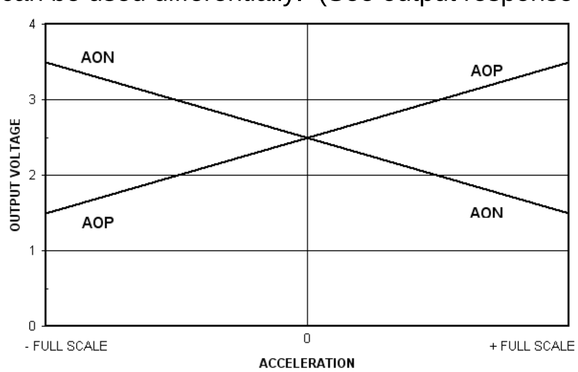

Figure 2 (Adding a Single Ended Output)

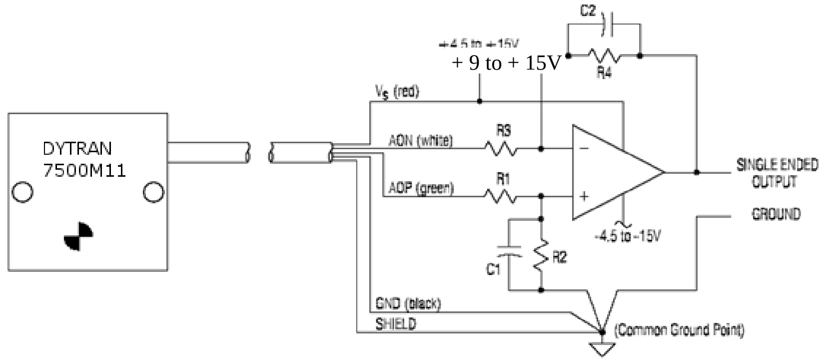

Figure 3 (Single Ended Mode Using a data acquisition system with an intergrated power supply)

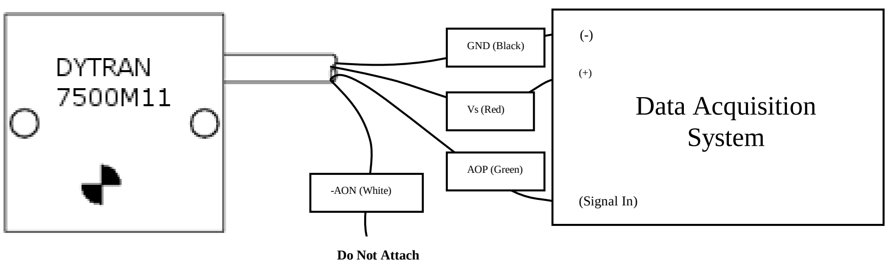

Figure 4 (Single Ended Mode Using a data acquisition system with a separate power supply)